Schruhl, Derek

From: Mike Ollivant <MOllivant@parametrix.com>
Sent: Monday, February 22, 2016 11:45 AM
To: steven.anderson@ihs.gov; Schruhl, Derek
Cc: Bill iyall; Heidi Still
Subject: FW: Back Of The Envelope Calculations - Clarification Calculations
Attachments: removed.txt; G3.pdf; WellInvetoryEPA-Revised20150922.pdf

Steve,

Provided are clarifying calculations which I have presented below in green based upon the design criteria for peak day flows included on the Design Criteria and Data (sheet G3 of the plan set attached). The peak day plant capacity was not included in the Feasibility Study but is included in the construction drawings so I can understand the need for clarification. I am available to discuss at your convenience for any of the information provided below.

Mike
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From: Anderson, Steven J (IHS/DES) [mailto:Steven.Anderson@ihs.gov]
Sent: Thursday, February 18, 2016 1:38 PM
To: Mike Ollivant; Schruhl, Derek (schruhl.derek@epa.gov)
Subject: Back Of The Envelope Calculations

Hi Mike,

Here are the back of the envelope calculations I did. I did something similar during the initial review that lead me to believe for phase one we have nothing to worry about. I looked at the full build out as to what is the possible impact of the site forever. This comes out of EIS type reviews. For example we wouldn't give someone a permit (or pass) to build Cooling Towers for a Nuclear Plant if we didn't also review what came after the Cooling Towers. It is reasonable to assume the Nuclear Plant would follow and therefor our review needs to consider it. We review the whole project. Anyway, maybe this will help narrow your focus in developing your redundancy submittal.

Thanks

Steve

Steve,

Agreed that its good practice to consider both Phase 1 and build out conditions for the Water Reclamation Plant and injection wells, as we included in the Feasibility Study and the Design Criteria and Data Sheet (attached). Parametrix clarifying calculations below include both Phase 1 plant capacity (195,000 gpd) and the buildout conditions of the plant (390,000 gpd). As a clarification the well inventory submitted and accepted by EPA is based on 7 wells and the Phase 1 plant capacity. The Cowlitz Tribe will need to submit a new well inventory should the plant be upgraded (increase capacity) and would be subject to EPA review.

Mike

Anderson Redundancy Notes:

The plant has three parts to it.

1. Front End includes lift stations and screens and the plant's capacity to bring in, screen raw sewer, and equalize flow. The EQ tank if built is part of the front end. This part of the plant needs to be capable of the instantaneous peak hourly load.
2. Treatment includes the train of individual unit processes. The train's slowest unit determines the max throughput for the plant.
3. Back End includes the effluent disposal and reclaimed water storage. This must be capable to either injecting or storing the max throughput of the plant. Anything that cannot be injected must be stored.

I will discuss this in terms of Two Trains and Four Trains. Also I will assume that we are talking about the MAX Weekend Flow. Max instantaneous flow and peak hour are good for designing pumps and pipes but not used to size the plant capacity. Max weekend for a resort type destination is appropriate.

Two Trains On Line (Steve – I've provided clarifying calculations based upon the peak day flow capacity listed in plan sheet G3)

Influent (max weekend) ~~257K gpd~~ – Projected Phase 1 weekend peak day flow is 190,000 gpd (Table 2 of the Feasibility Study).

Treatment Capacity ~~190K gpd~~ – Phase 1 peak day flow capacity 300,000 gpd (Sheet G-3 Design Criteria and Data).

Excess ~~67K gpd~~ – Excess treatment capacity of 110,000 gpd available - no storage required over peak day performance.

Over Two Days ~~134K gallons of storage required~~ – **No storage required** - plant has 110,000 gpd excess peak day treatment capacity available.

Storage available with two trains on line:

Equalization if it is built and if it is empty at 0 hour 110K gallons

Trains 3 and 4 if empty at 0 hour ~~202K~~ gallons – We are calculating available storage at 180,000 gallons to maintain some freeboard in tanks 3 and 4.

Total storage available ~~312K~~ gallons – Total storage 290,000 gallons

~~Since 312K gallons is greater that 134K gallons we are OK. This assumes the plant is operating at 100% capacity and that the EQ tanks is built and that EQ and Trains 3 and 4 are empty at the beginning of the weekend.~~

Two Treatment Trains – Phase 1 Development Conditions

I have provided calculation for storage for two treatment trains assuming the largest treatment unit (a single MBR cassette) out of service (Criteria for Sewage Works Design) and storage calculations assuming that one of two treatment trains is off line (exceeds the Criteria for Sewage Works Design requirements).

Storage Needed with One MBR Treatment Unit (a single MBR Cassette) off Line (one of eight total MBR cassettes are off line) – Criteria for Sewage Works Design.

Influent (max weekend) 190K gpd – Projected Phase 1 weekend peak day flow (Table 2 of the Feasibility Study)
Treatment Capacity 263K gpd – Phase 1 peak day flow capacity with one MBR cassette off line.
Excess Treatment Capacity 73K gpd – Excess peak day treatment capacity available no storage required.
Over Two Days No storage required - 180K of storage available Ok.

Storage Needed with One Complete Treatment Train Off Line – Phase 1 Development (initial Casino Development) – exceeds requirements for Criteria for Sewage Works Design.

Influent (max weekend) 190K gpd – Projected Phase 1 weekend peak day flow (Table 2 of the Feasibility Study)

Treatment Capacity 150K gpd – Phase 1 peak day flow capacity with one treatment train off line.
Daily Storage Needed 40K gpd
Over Two Days 80K gallons of storage required – 180K of storage (trains 3 and 4 only) available Ok … approximately 4+ days of peak day storage available.

No storage is required unless one train is off line for extended periods of time.

Four Treatment Trains – Buildout Conditions

I have provided calculation for storage using the Criteria for Sewage Works Design for four treatment trains with the largest treatment unit (a single MBR cassette) out of service and calculation assuming that one of four treatment trains is off line. Assuming that a complete treatment train is off line is beyond the Criteria for Sewage Works Design requirements.

Four Trains On Line (Steve – I've shown revised calculations based upon the peak day flow capacity listed in the plan sheets)
Influent (max weekend) 525K gpd – Agree buildout weekend peak day flow estimated at 525K gpd (Table 2 of Feasibility Study)
Treatment Capacity ~~390K gpd~~ – Final Phase peak day flow capacity 600,000 gpd (Sheet G-3 Design Criteria and Data)
Excess ~~135K gpd~~ – 75K gpd excess treatment capacity available no storage required
Over Two Days ~~270K gallons of storage required~~ – No storage required plant has 75K excess peak day treatment capacity available.

Storage Needed with One MBR Treatment Unit (Cassette) off Line (one of sixteen total MBR cassettes are off line) – Criteria for Sewage Works Design

Influent (max weekend) 525K gpd – Projected Phase 1 weekend peak day flow (Table 2 of the Feasibility Study)
Treatment Capacity 563K gpd – Phase 1 peak day flow capacity with one MBR cassette off line.
Excess Treatment Capacity 38K gpd – Excess peak day treatment capacity available no storage required.
Over Two Days No storage required – Future above ground storage available Ok.

Three Trains On Line (one train off line) – exceeds requirements for Criteria for Sewage Works Design
Influent (max weekend) 525K gpd – Buildout weekend peak day flow estimated at 525K gpd (Table 2 of Feasibility Study).
Treatment Capacity 450K gpd – Buildout peak day flow capacity with three trains on line (75% of peak day capacity Sheet G-3 Design Criteria and Data).
Daily Storage Needed 75K gpd of storage would be needed for 24 hours of storage.
Over Two Days 150K gallons of storage required if 48 hour of storage criteria applied – storage requirements would be finalized when buildout well inventory is submitted.

Storage is only needed if one train is off line for an extended period of time during peak flow conditions. The Criteria for Sewage Works Design only requires that the treatment facility assume the largest treatment unit (a single MBR cassette) is out of service at any time.

~~Storage available with four trains on line:~~

~~Equalization if it is built and if it is empty at 0 hour 110K gallons~~
~~Total storage available 110K gallons~~

~~Since 110K gallons is much less than 270K gallons we are NOT OK. In this case 160K gallons of effluent has nowhere to go. This assumes the plant is operating at 100% capacity and the EQ tank is empty at the beginning of the weekend.~~

Redundancy

Under the example above there appears to be sufficient hydraulic redundancy for 2 trains on. For 4 trains on there is not sufficient hydraulic redundancy. Redundancy can also be mitigated by having spare parts for pumps and controls and alternatives for the influent. My closest comparison is USIT. USIT is directly into the aquifer Cowlitz isn't. In terms of redundancy the USIT plant differs significantly.

USTI Cowlitz Concern

NPDWR at end of plant Yes No Quality Redundancy
Alternative Disposal 100% 0% Quantity Redundancy

I'm unable to make a comparison to the USIT, however the Cowlitz plant has sufficient hydraulic capacity / effluent quality redundancy / storage to meet or exceed the Criteria for Sewage Works Design for both a 2 and 4 train configuration.

Obviously if a plant is upset and cannot discharge effluent it can always shut down and stop generating e**fflu**ent. The Water Reclamation and Reuse Standards require 24 hours of emergency storage. This is intended for short term. The standards also require 20 days of storage for if they are relying on storage to meet redundancy requirements.

The water reclamation plant and injection wells are designed as an onsite wastewater system and as such the Water Reclamation and Reuse Standards do not apply. However, the plant is design to provide reclaimed water in the future, but initially all of the water will be discharged in the injection wells. Additional safeguard for the injection wells and ground water have been included in the design including:

- Each treatment train is equipped with a turbidity meter that will read continuously. Should the quality of the effluent near .2 ntu's (reclaimed water standards for average .5 ntu peak) the individual treatment train pump system will shut off and the operator will be sent an alarm to fix that treatment train. Storage may be used (automatic) only if the flow (at the time of the alarm) exceeds the capacity of the remaining treatment train(s). Please note that each treatment train can treat peak hour flow of 300,000 gpd for an extended period of 4 hours.
- As outlined above storage is being provided as an addition to redundancy required under the Orange Book (guidance). During the Phase 1 construction 180,000 gallons is being provided for raw sewage storage (1.6 days of storage – winter average daily flow) and 150,000 gallons of reclaimed water storage (1.4 days of storage – winter average daily flow). Phase 1 will have 2-3 days of storage in addition to complete system redundancy.

The plant as designed can meet the 24 hours of storage in the 2 train configuration but not the 4 train configuration. It relies on the additional storage from trains 3 and 4.

Please see the revised calculations above. **Storage is not required using the Washington State Criteria for Sewage Works Design (Orange Book) as guidance, for either the initial Phase 1 capacity or buildout conditions (see calculations below). Assuming one treatment train being off line, storage is a prudent improvement (for Phase 1 or buildout conditions) but exceeds the requirements of the Orange Book.** 24 hours of storage can be provided in the 4 train configuration should that amount of storage be required at the time the next well inventory is submitted.

Surface Drain field verses Vadose Zone Injection wells (deeper that 10 -15 feet). There is some question about how much biological treatment takes place deep into the strata. There is a significant amount of biological stabilization in the top 5 feet of soil. Perhaps because oxygen can easily get there or because there are many bugs there. I have worked on a few Soil Vapor Extraction and Air Sparging sites to clean up spilled fuel. Volatilization of the organics is happening but biological treatment is uncertain and hard to measure. I don't have any references for deeper biological stabilization. The simple question is are the bugs there and do they have water and oxygen and enough heat to do their job?

We will provide additional information regarding treatment in the soil under separate cover with the redundancy submittal.

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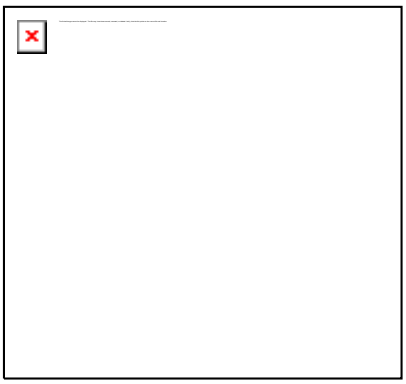

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